Fermilab Response to Physicist Resources Report

Presentation to HEPAP

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Tevatron Collider Experiment Task Force

- **Origin: Concern about physicist staffing for Run 2 operations, data reduction, and physics analysis**
  - **Catalyzed in part by HEPAP**
- **Charge (abbreviated) by Fermilab Director Pier Oddone**
  - **to evaluate the personnel resources needed to operate CDF and DØ through 2009 and to perform the physics analysis of the data in a timely fashion; to compare these needs to estimates of the personnel resources available from the two collaborations and Fermilab; to identify shortfalls or gaps; and to suggest remedies.**
- **Conclusion: That the physicist resources will be available to operate CDF and D0 through 2007 and complete the key data analyses, and a significant amount more, in a timely fashion. That the physicist resources will be available to operate CDF and D0 through 2009 and complete the *the most important* data analyses in a timely fashion, but there are risks. We are working with domestic and international funding agencies to mitigate those risks!**

Composition of the Task Force

- CDF and D0 Co-Spokespersons
- Leaders of CDF and D0 Operations, Computing and Physics Analysis groups
  - International Representatives
  - Chip Brock, for connection to HEPAP resource study
- Leaders of Particle Physics Division and Computing Division – the major suppliers of laboratory resources to the experiments

This group discussed/debated very difficult issues concerning the endgame of experiments that many had spent their careers working on. They also carried the discussion to the full collaborations. The process took 6 months and will continue.

Physicist Supply/Demand

- **Supply Side: The number of physicist FTEs available to each experiment is expected to decline from 2005 levels by approximately 27% by 2007 and 56% by 2009. We find that the HEPAP personnel survey and the MOU surveys carried out by the experiments agree well in 2005 and 2007.**
- **Demand side: The original HEPAP estimate was a "top down estimate" made during the midst of the Run 2 upgrade and when the data analysis was in an early stage of development. Here the collaborations and Fermilab have done a major amount of new work – work that only they can do!**
  - **For CDF, the current estimates for operations agree well with HEPAP estimates but the current best estimates for physics analysis are lower due to a difference in the scope of the physics program that is delivered.**
  - **For DØ, it is just the reverse. The effort needed to deliver the operational program is substantially lower than those reported to the HEPAP survey whereas that devoted to physics analysis is consistent with HEPAP.**

Operations

- **As the detector matures, problems get eliminated, quality monitoring, problem detection and problem resolution get automated. The need for shift and on-call personnel has been decreasing steadily and will continue to do so.**
- **As the luminosity reaches an asymptote, triggers stabilize**
- **However, other factors will create new problems**
  - **the larger datasets will require more computing and more human effort to process**
  - **Radiation damage and detector aging will require more attention**
- **The report makes several recommendations to decrease the number of physicists needed for operations by:**
  - **transferring more of the expert responsibilities to permanent laboratory staff;**
  - **improving shift efficiency by having longer tours of duty to reduce learning curves and overall need;**
  - **automating the monitoring and detection of problems and eliminating problems that require protracted attention;**
  - **improving documentation and trouble-shooting procedures; and,**
  - **In computing, adopting common solutions wherever possible, moving key infrastructure into centrally supported services, and leveraging the effort devoted to LHC grid technologies.**

Physics Analysis

- This is the hardest issue to understand
- Based on ensuring that analysis of a “core” set of TEN high-impact physics topics is done in a timely fashion.
- These are the physics topics that are usually cited as the justification for achieving high integrated luminosities
- The algorithm development for these ten enables a much broader range of analyses, which can then be done with small additional effort if physicists are available. This assures openness to the unexpected.
- Uncertainties relate to how much discipline can be applied to focus people on these primary analysis goals.
  - **Therefore two somewhat different approaches were taken to establish a range of possible needs**

Resource Balance

	CDF		DØ	
	2005	**2007**	**2005**	**2007**
HEPAP,US	256	176	237	155
US	267	194	240	170
Foreign	167	125	228	175
US+Foreign	434	319	468	345

	2007		2009	
	CDF	D0	CDF	D0
Required	207 ~ 252	251 ~ 330	175 ~ 222	190 ~ 248
Available	319	345	191	200
Required - Available	112 ~ 67	94 ~ 15	16 ~ -31	10 ~ -48

- **In 2007, we have sufficient labor according to both methods we used. There are enough resources to deliver considerably more than just the core physics.**

•By 2009, the situation is less clear with one analysis showing that there is sufficient effort to deliver the core and the other showing modest shortfalls with respect to a broader physics program. The situation is certainly better than previous, less rigorous analyses suggest.

•We view this as a cause of concern, but not panic, and propose to mitigate these risks by enacting remedies set at the level of the shortfalls these analyses indicate we are likely to have

•Note that the two experiments together have 400 FTEs committed through 2009 even in the face of competition and uncertainties.

Recommendations to Fermilab

1. **Require the divisions to update the laboratory staff profile needed to fulfill Fermilab responsibilities to complete the Tevatron program Ongoing**
2. **Communicate to Fermilab staff scientists engaged in the Tevatron collider program the laboratory staff plan for the Tevatron and LHC, and plans for future CMS membership opportunities. Ongoing**
3. **Encourage the experiments and divisions to continue developing efficiencies that reduce the effective labor required to operate the Run II programs. In progress**
4. **Continue to promote the Tevatron program to incoming Research Associates, and, starting in FY06, increase the number of CDF and DØ RA positions by two each. Recruiting for two each additional post docs**
5. **Periodically review with the collaboration spokespeople the degree to which institutional MOU commitments are honored. Planned**
6. **Provide strong support for the LHC Physics Center (LPC) at Fermilab and for Fermilab's US CMS hosting activities. Ongoing In addition, we recommend expansion of the LPC to include limited support for members of ATLAS working on Run II. Under consideration**
7. **Pursue discussions with the International Finance Committee (IFC) from both collaborations to secure and understand their commitments to the program through 2009. Discussions continue at next IFC meetings**

Recommendations for Joint Action

1. **Increase visitor budgets for outside personnel by approximately a factor of two. **allows flexible response to shortfalls in expertise.**
2. **In concert with the collaboration spokespeople, conduct negotiations with NSF, DOE, and foreign funding sources aimed at retaining or enhancing support for University resources in the areas of greatest risk.**
3. **Discuss jointly with LHC and Tevatron experimental leadership the difficulties faced by groups and individuals active in both programs. These groups frequently find it difficult to fully contribute to two programs through the Tevatron-LHC transition period.**
4. **Explore the possibility of contributions from the funding agencies for the creation of Tevatron Fellowships to support named university students (5-10 per experiment).**
5. **Similarly, explore the possibility of support from the funding agencies for the creation of Hadron Collider Fellowships to support post-docs (3-6 per experiment) resident at Fermilab. The three or four-year fellowships might initially focus on the Tevatron program with a transition to LHC occurring late in the second or early in the third year of the Fellowship.**

Actions Taken/Next Steps - I

- **Fermilab would like to get a fast start in ’06, but the ’06 budget is very tight and constrains what it can do:**
  - **PPD:**
    - **Exploring and implementing efficiencies in operations**
    - **Expanding the number of RAs and, to a limited extent, the Guest and Visitors program**
    - **Making some staff reassignments to CDF and D0**
  - **CD:**
    - **CDF/D0:**
      - **Online systems now administered by a central group.**
      - **Significant progress on common data handling technology**
      - **guest scientist/consultant (s) will be hired to help implement common solutions and access to world-wide grid resources.**
    - **CDF: Migration of the CDF data logging system away from SGI machines to a centrally served modern Linux environment.**
    - **D0: Effort recently focused on infrastructure to exploit global grid systems, many from CMS, which delivered a major time-critical (winter conferences) reprocessing of data.**

Actions Taken/Next Steps - II

- **Fermilab has begun to discuss with funding agencies how additional resources could help mitigate the risks we have discussed**
  - **With a problem of this type, modest increments in available resources can make big differences, especially in supporting more guests and visitors who are eager to work on the experiments**
  - **Improved funding for universities, expected in '07, will provide them with more flexibility that should help**
  - **A firm commitment on 2008/2009 running would allow international partners, who provide half of the total effort and who have stated their support through 2009, to solidify their plans**
- **If the collaborations, Fermilab, DOE, NSF, and the international funding agencies work together, it will be possible to have a successful transition to the next phase of exploration of the High Energy Frontier**